



U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

ENERGY SAVINGS OPPORTUNITY SURVEY

DUGWAY PROVING GROUND

FY86

EXECUTIVE SUMMARY

19971021 297

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ENGINEERING CONSULTING RESOURCES, INC.
SALT LAKE CITY, UTAH

ENERGY SAVINGS OPPORTUNITY SURVEY
for the
ENERGY ENGINEERING ANALYSIS PROGRAM

DUGWAY PROVING GROUND
Dugway, Utah

Contract No. DACA05-86-0088

For
Sacramento District
CORPS OF ENGINEERS

September 1987



ENGINEERING CONSULTING RESOURCES, INC.
4609 South 2300 East, Suite 101
Salt Lake City, Utah 84117
(801) 277-7879

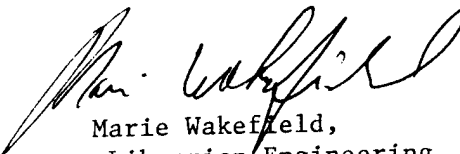


DEPARTMENT OF THE ARMY
CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS
P.O. BOX 9005
CHAMPAIGN, ILLINOIS 61826-9005

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17 Sep 1997

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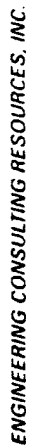

Marie Wakefield,
Librarian Engineering

EXECUTIVE SUMMARY

An Energy Savings Opportunity Survey (ESOS) has been completed for the U.S. Army Dugway Proving Ground facility located at Dugway, Utah. This work, conducted as part of the Energy Engineering Analysis Program (EEAP), included: a review of previous studies; an evaluation of selected projects and energy conservation opportunities (ECOs); a site survey of 53 selected buildings to identify additional ECOs; analysis of the energy and cost savings and ECOs project costs; and preparation of project documentation for funding and implementation.

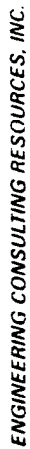
Over 150 different energy conservation opportunities (ECOs), shown on pages 2 through 5, were identified during this ESOS. Economic analysis indicates that only 106 of these ECOs had a savings-to-investment (SIR) ratio greater than one. The estimated savings from the 106 ECOs was nearly 45,000 MBTU or 15% of the FY84-85 overall energy (MBTU) usage. Cost savings for the 106 ECOs are estimated to approach \$271,000 or 9% of the same period. Most all of the ECOs identified save fuel oil rather than electricity. Total savings from the fuel oil ECOs exceed \$260,000 or over 19% of the FY84-85 fuel oil usage.

Seven projects were selected by Dugway Proving Ground for funding and implementation. These projects, outlined on pages 6 - 7 with supporting data starting on page 8, are estimated to save 44,000 MBTUs and over \$267,900 annually. The estimated cost for design and construction of these projects is approximately \$1,197,000.



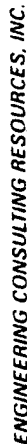
Energy Savings Opportunity Survey

ANNEX A
ECO #



Energy Savings Opportunity Survey

ECO PROJECT



Energy Savings Opportunity Survey

BLDG #	NAME	LOCATION	ANNEX A ECO #					
			14	47	62	66	67	
1004	Air Filter Bldg	Avery						
1006	Battery Shop	Avery						
1010	Operations Bldg	Avery			●			
1012	GLCM Maint Bldg	Avery						
1020	Ordinance Field Maint	Avery	●					
1034	Fuse Loading Bldg	Avery						
1040	Vehicle Maint Bldg	Avery	●					
2028	Baker Laboratory	Baker	●	●		●		
2032	Fermentation Bldg	Baker						
2048	Boiler House	Baker			●			
3046	Surveillance Bldg	Carr						
3056	Final Engineering Bldg	Carr						
3080	Administration & Shop	Carr	●	●		●		
3096	Change House	Carr		●				
4003	Fire & Rescue Station	Ditto						
4006	Air Operation Bldg	Ditto						
4010	Hanger	Ditto						
4053	Water Treatment Plant	Ditto						
4090	Moral Support Facility	Ditto						
4110	Chemistry Laboratory	Ditto	●					
4117	Photo/Instrument Bldg	Ditto						
4120	Chemistry Laboratory	Ditto	●					
4126	MT Offices/Range Control	Ditto						
4132	Communication Maint Bldg	Ditto						
4190	Standby Generator Bldg	Ditto						
4204	Technical Laundry Bldg	Ditto						
4220	Ecology & Epidemiology	Ditto	●					



ENGINEERING CONSULTING RESOURCES, INC.

Energy Savings Opportunity Survey

ECO PROJECT

ANNEX A
ECO #

BLDG # NAME LOCATION

4233	Electronic/Electric Shop	Ditto
5100	Post Chapel	English Village
5111	Gymnasium	English Village
5212	Fire Station	English Village
5222	Military Mens Quarters	English Village
5230	DPG Community Club	English Village
5234	Child Care Center	English Village
5236	Station Hospital	English Village
5240	Hospital Dormitory	English Village
5300	DPG Community Club Annex	English Village
5314	EM Barracks & Mess	English Village
5326	Dugway Mall	English Village
5330	Administration Bldg	English Village
5438	Provost Marshal Office	English Village
5450	Post Headquarters	English Village
5454	Transportation Office	English Village
5460	Craft Shop	English Village
5470	Auto Motor Maint Shop	English Village
5474	FE Offices & Shop	English Village
5533	Steam Cleaning Facility	English Village
5666	Heating Plant	English Village
5710	Operations Bldg	English Village
6002	Supply Warehouse	Fries Park
6008	Self Service Supply	Fries Park
6016	Supply Office Bldg	Fries Park
6048	Communications Storage	Fries Park

More Efficient Lighting Source
Solar DHW System
Boiler Replacement
Solar Heating
EMCS

14 47 62 66 67

ENERGY SAVINGS OPPORTUNITY SURVEY PROJECTS

Project #1 - The three ECOs selected for this project will be implemented at eight DPG facilities and includes: modifications to the existing automatic temperature controls, permanent night setback temperature controls, and modifications to existing light switching. The project will be funded under the Quick Return on Investment Program (QRIP).

MBTU Savings	Cost Savings	Project Cost	
-----	-----	-----	
8,344	\$ 50,085	\$ 68,795	Simple Payback: 1.4 yrs

Project #2 - The four ECOs selected for this project will be implemented at 39 DPG facilities and includes: night setback temperature controls, an economizer, pipe and tank insullation, and automatic door closers. The project will be funded under Office, Secretary of Defense Productivity Investment Funding (OSD PIF).

MBTU Savings	Cost Savings	Project Cost	
-----	-----	-----	
17,215	\$104,269	\$316,883	Simple Payback: 3.0 yrs

Project #3 - The ECO selected for this project will be implemented at six DPG facilities. The ECO includes roof and/or wall insulation. The project will be funded under Office, Secretary of Defense Productivity Investment Funding (OSD PIF).

MBTU Savings	Cost Savings	Project Cost	
-----	-----	-----	
4,958	\$ 29,312	\$ 84,438	Simple Payback: 2.9 yrs

Project #4 - The ECO selected for this project will be implemented at nine DPG facilities. The ECO includes roof and/or wall insulation. The project will be funded as a Low Cost/No Cost type project.

MBTU Savings	Cost Savings	Project Cost	
-----	-----	-----	
1,663	\$ 9,825	\$141,361	Simple Payback: 14.4 yrs

ESOS PROJECTS - CONTINUED

Project #5 - The ECO selected for this project will be implemented at nine DPG facilities. The ECO includes interior storm windows. The project will be funded as a Low Cost/No Cost type project.

MBTU Savings	Cost Savings	Project Cost	
-----	-----	-----	
1,858	\$ 10,994	\$116,708	Simple Payback: 10.6 yrs

Project #6 - The ECO selected for this project will be implemented at one DPG facility. The ECO includes infrared oil-fired heaters. The project will be funded as a Low Cost/No Cost type project.

MBTU Savings	Cost Savings	Project Cost	
-----	-----	-----	
2,031	\$ 12,959	\$154,431	Simple Payback: 11.9 yrs

Project #7 - The ten ECOs selected for this project will be implemented at 18 DPG facilities and includes: weather stripping and caulking, replacement of incandescent light fixtures, infrared oil-fired heaters, shower flow restrictors, heat recovery systems, swimming pool cover, motor speed controls, evaporative cooler controls, fluorescent ballast controls, and photoelectric light switches. The project will be funded as a Low Cost/No Cost type project.

MBTU Savings	Cost Savings	Project Cost	
-----	-----	-----	
8,385	\$ 50,498	\$314,490	Simple Payback: 6.2 yrs

PROJECT #1

=====COST ESTIMATE SUMMARY=====

PROJECT: PROJECT #1 FUNDING = QRIP

REF: PROJ #1
DATE: AUG 1987
BY: CMY

DESCRIPTION:

PROJECT #1 :CONTROL AND LIGHTING MODIFICATIONS
QRIP

BLDG. #	ECO #	CONSTRUCTION COST	CONTRACT COST	TOTAL COST
2028	42	\$10,264	\$1,232	\$11,496
4110	42	\$14,878	\$1,785	\$16,663
4120	42	\$10,182	\$1,222	\$11,405
5222	42	\$24,542	\$2,945	\$27,488
1006	49	\$686	\$82	\$768
4053	49	\$111	\$49	\$460
5300	49	\$359	\$43	\$402
4090	61	\$99	\$12	\$111
TOTALS		\$61,424	\$7,371	\$68,795

=====SAVINGS SUMMARY=====

PROJECT: PROJECT #1 FUNDING = QRIP

REF: PROJ #1
DATE: AUG 1987
BY: CMY

DESCRIPTION:

PROJECT #1 :CONTROL AND LIGHTING MODIFICATIONS
QRIP

BLDG. #	ECO #	--THERMAL ENERGY--		----ELECTRICAL ENERGY----			TOTAL SAVINGS
		MBTU	DOLLARS	KWH	MBTU	DOLLARS	
2028	42	1023	\$6,047	0	0	\$0	\$6,047
4110	42	2210	\$13,064	55313	189	\$1,830	\$14,894
4120	42	3611	\$21,346	0	0	\$0	\$21,346
5222	42	422	\$2,494	0	0	\$0	\$2,494
1006	49	503	\$2,972	0	0	\$0	\$2,972
4053	49	21	\$123	0	0	\$0	\$123
5300	49	351	\$2,072	2043	7	\$68	\$2,140
4090	61	0	\$0	2097	7	\$69	\$69

TOTALS 8141 \$48,118 59453 203 \$1,967 \$50,085

TOTAL MBTU = 8141 THERMAL + 203 ELECT. = 8344 TOTAL MBTU

PROJECT #2

=====COST ESTIMATE SUMMARY=====

PROJECT: PROJECT #2 FUNDING = OSD-PIF

REF: PROJ #2
DATE: AUG 1987
BY: CMY

DESCRIPTION:

PROJECT #2 :NIGHT SETBACK, ECONOMIZER, INSULATION AND AUTOMATIC
OSD-PIF DOOR CLOSERS

BLDG. #	ECO #	CONSTRUCTION COST	CONTRACT COST	TOTAL COST
1010	17	\$7,439	\$893	\$8,332
1012	17	\$3,025	\$363	\$3,388
1020	17	\$2,837	\$340	\$3,177
1040	17	\$622	\$75	\$697
2032	17	\$726	\$87	\$813
3046	17	\$1,037	\$124	\$1,161
3056	17	\$2,454	\$295	\$2,749
3080	17	\$6,490	\$779	\$7,269
3096	17	\$1,367	\$164	\$1,531
3096	53	\$1,426	\$171	\$1,597
4003	17	\$1,752	\$210	\$1,962
4003	54	\$3,040	\$365	\$3,405
4006	17	\$1,665	\$200	\$1,865
4010	17	\$9,336	\$1,120	\$10,456
4090	17	\$311	\$37	\$348
4117	17	\$3,971	\$477	\$4,448
4126	17	\$15,125	\$1,815	\$16,940
4132	17	\$484	\$58	\$542
4204	17	\$1,353	\$162	\$1,515
4220	17	\$1,453	\$174	\$1,627
SUBTOTAL THIS PAGE		\$65,913	\$7,909	\$73,822

=====COST ESTIMATE SUMMARY=====

PROJECT: PROJECT #2

PAGE 2

REF: PROJ #2
DATE: AUG 1987
BY: CMY

DESCRIPTION:

PROJECT #2 :NIGHT SETBACK, ECONOMIZER, INSULATION AND AUTOMATIC
OSD-PIF DOOR CLOSERS

BLDG. #	ECO #	CONSTRUCTION COST	CONTRACT COST	TOTAL COST
SUBTOTAL PREV PAGE		\$65,913	\$7,909	\$73,822
4233	17	\$7,081	\$850	\$7,931
5100	17	\$755	\$91	\$846
5111	17	\$14,579	\$1,750	\$16,329
5212	17	\$8,823	\$1,059	\$9,882
5212	54	\$2,027	\$243	\$2,270
5230	17	\$15,694	\$1,883	\$17,577
5234	17	\$18,549	\$2,226	\$20,775
5236	17	\$15,627	\$1,875	\$17,502
5236	53	\$1,088	\$131	\$1,219
5240	17	\$1,634	\$196	\$1,830
5314	17	\$52,174	\$6,261	\$58,435
5326	17	\$3,715	\$446	\$4,161
5330	17	\$13,362	\$1,603	\$14,965
5438	17	\$4,411	\$529	\$4,940
5450	17	\$10,828	\$1,299	\$12,127
5450	19	\$8,111	\$973	\$9,084
5454	17	\$910	\$109	\$1,019
5460	17	\$15,554	\$1,866	\$17,420
5470	17	\$8,163	\$980	\$9,143
SUBTOTAL PAGES 1&2		\$269,003	\$32,279	\$301,282

=====COST ESTIMATE SUMMARY=====

PROJECT: PROJECT #2

PAGE 3

REF: PROJ #2
DATE: AUG 1987
BY: CMY

DESCRIPTION:

PROJECT #2 :NIGHT SETBACK, ECONOMIZER, INSULATION AND AUTOMATIC
OSD-PIF DOOR CLOSERS

BLDG. #	ECO #	CONSTRUCTION COST	CONTRACT COST	TOTAL COST
<hr/>				
SUBTOTAL PAGES 1&2		\$269,003	\$32,279	\$301,282
5470	54	\$6,080	\$730	\$6,810
5474	17	\$1,821	\$218	\$2,039
6002	17	\$428	\$51	\$479
6008	17	\$1,029	\$123	\$1,152
6016	17	\$2,193	\$263	\$2,456
6016	53	\$669	\$80	\$749
6048	17	\$1,709	\$205	\$1,914
<hr/>				
TOTAL PAGES 1,2&3		\$282,934	\$33,949	\$316,883

=====SAVINGS SUMMARY=====

PROJECT: PROJECT #2 FUNDING = OSD-PIF

REF: PROJ #2
DATE: AUG 1987
BY: CMY

DESCRIPTION:

PROJECT #2 :NIGHT SETBACK, ECONOMIZER, INSULATION AND AUTOMATIC
OSD-PIF DOOR CLOSERS

BLDG. #	ECO #	--THERMAL ENERGY--		----ELECTRICAL ENERGY----			TOTAL SAVINGS
		MBTU	DOLLARS	KWH	MBTU	DOLLARS	
1010	17	832	\$4,918	14462	49	\$479	\$5,396
1012	17	62	\$365	463	2	\$15	\$380
1020	17	704	\$4,160	3777	13	\$125	\$4,285
1040	17	82	\$487	621	2	\$21	\$508
2032	17	343	\$2,026	1195	4	\$40	\$2,065
3046	17	180	\$1,065	1909	7	\$63	\$1,128
3056	17	228	\$1,350	2851	10	\$94	\$1,445
3080	17	142	\$839	265	1	\$9	\$848
3096	17	171	\$1,012	1296	4	\$43	\$1,055
3096	53	198	\$1,173	0	0	\$0	\$1,173
4003	17	63	\$371	128	0	\$4	\$375
4003	54	106	\$629	0	0	\$0	\$629
4006	17	189	\$1,117	1040	4	\$34	\$1,151
4010	17	319	\$1,885	1259	4	\$42	\$1,927
4090	17	86	\$509	1034	4	\$34	\$543
4117	17	579	\$3,424	5123	17	\$170	\$3,594
4126	17	273	\$1,616	4340	15	\$144	\$1,760
4132	17	332	\$1,960	3885	13	\$129	\$2,089
4204	17	667	\$3,944	2780	9	\$92	\$4,036
4220	17	565	\$3,340	7086	24	\$234	\$3,574

SUBTOTAL THIS PAGE		6121	\$36,190	53514	183	\$1,772	\$37,961

=====SAVINGS SUMMARY=====

PROJECT: PROJECT #2

PAGE 2

REF: PROJ #2
DATE: AUG 1987
BY: CMY

DESCRIPTION:

PROJECT #2 :NIGHT SETBACK, ECONOMIZER, INSULATION AND AUTOMATIC
OSD-PIF DOOR CLOSERS

BLDG. #	ECO #	--THERMAL ENERGY--		----ELECTRICAL ENERGY----		TOTAL SAVINGS
		MBTU	DOLLARS	KWH	MBTU DOLLARS	
SUBTOTAL PREV PAGE		6121	\$36,190	53514	183 \$1,772	\$37,961
4233	17	290	\$1,714	1386	5 \$46	\$1,760
5100	17	167	\$990	0	0 \$0	\$990
5111	17	661	\$3,909	3358	11 \$111	\$4,020
5212	17	252	\$1,489	0	0 \$0	\$1,489
5212	54	99	\$587	0	0 \$0	\$587
5230	17	376	\$2,225	866	3 \$29	\$2,254
5234	17	510	\$3,013	0	0 \$0	\$3,013
5236	17	1285	\$7,597	23703	81 \$784	\$8,381
5236	53	63	\$371	0	0 \$0	\$371
5240	17	286	\$1,690	0	0 \$0	\$1,690
5314	17	1341	\$7,926	3842	13 \$127	\$8,053
5326	17	300	\$1,776	0	0 \$0	\$1,776
5330	17	832	\$4,921	0	0 \$0	\$4,921
5438	17	99	\$584	871	3 \$29	\$613
5450	17	337	\$1,990	8727	30 \$289	\$2,279
5450	19	0	\$0	69793	238 \$2,310	\$2,310
5454	17	196	\$1,159	5201	18 \$172	\$1,331
5460	17	1364	\$8,064	8609	29 \$285	\$8,349
5470	17	330	\$1,953	2039	7 \$67	\$2,020
SUBTOTAL PAGES 1&2		14909	\$88,148	181909	621 \$6,021	\$94,168

=====SAVINGS SUMMARY=====

PROJECT: PROJECT #2

PAGE 3

REF: PROJ #2
DATE: AUG 1987
BY: CMY

DESCRIPTION:

PROJECT #2 :NIGHT SETBACK, ECONOMIZER, INSULATION AND AUTOMATIC
OSD-PIF DOOR CLOSERS

BLDG. #	ECO #	--THERMAL ENERGY--		----ELECTRICAL ENERGY----		TOTAL SAVINGS
		MBTU	DOLLARS	KWH	MBTU DOLLARS	
SUBTOTAL PAGES 1&2		14909	\$88,148	181909	621 \$6,021	\$94,168
5470	54	333	\$1,969	0	0 \$0	\$1,969
5474	17	447	\$2,645	0	0 \$0	\$2,645
6002	17	69	\$410	604	2 \$20	\$430
6008	17	312	\$1,846	2718	9 \$90	\$1,936
6016	17	220	\$1,300	1244	4 \$41	\$1,341
6016	53	15	\$89	0	0 \$0	\$89
6048	17	259	\$1,532	4778	16 \$158	\$1,690
TOTAL PAGES 1,2&3		16562	\$97,939	191252	653 \$6,330	\$104,269
TOTAL MBTU =		16562 THERMAL +	653 ELECT. =		17215	TOTAL MBTU

PROJECT #3

=====COST ESTIMATE SUMMARY=====

PROJECT: PROJECT #3 FUNDING = OSD-PIF

REF: PROJ #3
DATE: AUG 1987
BY: CMY

DESCRIPTION:

PROJECT #3 :ROOF AND/OR WALL INSULATION
OSD-PIF

BLDG. #	ECO #	CONSTRUCTION COST	CONTRACT COST	TOTAL COST
1006	1	\$1,468	\$176	\$1,644
1020	1	\$5,198	\$624	\$5,822
4010	1	\$7,658	\$919	\$8,577
4132	1	\$2,772	\$333	\$3,105
5470	1	\$37,604	\$4,513	\$42,117
5474	1	\$20,692	\$2,483	\$23,175

TOTALS		\$75,390	\$9,048	\$84,438

ENGINEERING CONSULTING RESOURCES, INC.
4609 South 2300 East, Salt Lake City, Utah, 84117

Consulting Engineers
(801) 277-7879

=====SAVINGS SUMMARY=====

PROJECT: PROJECT #3 FUNDING = OSD-PIF

REF: PROJ #3
DATE: AUG 1987
BY: CMY

DESCRIPTION:

PROJECT #3 :ROOF AND/OR WALL INSULATION
OSD-PIF

BLDG. #	ECO #	--THERMAL ENERGY--		----ELECTRICAL ENERGY----		TOTAL	
		MBTU	DOLLARS	KWH	MBTU	DOLLARS	SAVINGS
1006	1	194	\$1,149	0	0	\$0	\$1,149
1020	1	631	\$3,729	0	0	\$0	\$3,729
4010	1	530	\$3,131	0	0	\$0	\$3,131
4132	1	208	\$1,230	0	0	\$0	\$1,230
5470	1	2735	\$16,171	0	0	\$0	\$16,171
5474	1	660	\$3,902	0	0	\$0	\$3,902
TOTALS		4958	\$29,312	0	0	\$0	\$29,312

PROJECT #4

ENGINEERING CONSULTING RESOURCES, INC.
4609 South 2300 East, Salt Lake City, Utah, 84117

Consulting Engineers
(801) 277-7879

=====COST ESTIMATE SUMMARY=====

PROJECT: PROJECT #4 FUNDING = LOW COST/NO COST

REF: PROJ #4
DATE: AUG 1987
BY: CMY

DESCRIPTION:

PROJECT #4 :ROOF AND/OR WALL INSULATION
LOW COST/NO COST

BLDG. #	ECO #	CONSTRUCTION COST	CONTRACT COST	TOTAL COST
1010	1	\$8,910	\$1,069	\$9,979
3080	1	\$6,256	\$751	\$7,007
4006	1	\$8,483	\$1,018	\$9,501
4126	1	\$9,646	\$1,157	\$10,803
5450	1	\$32,027	\$3,843	\$35,870
5460	1	\$25,329	\$3,039	\$28,368
6008	1	\$19,860	\$2,383	\$22,243
6016	1	\$7,445	\$893	\$8,338
6048	1	\$8,258	\$991	\$9,249
TOTALS		\$126,214	\$15,147	\$141,361

ENGINEERING CONSULTING RESOURCES, INC.
4609 South 2300 East, Salt Lake City, Utah, 84117

Consulting Engineers
(801) 277-7879

=====SAVINGS SUMMARY=====

PROJECT: PROJECT #4 FUNDING = LOW COST/NO COST

REF: PROJ #4
DATE: AUG 1987
BY: CMY

DESCRIPTION:

PROJECT #4 :ROOF AND/OR WALL INSULATION
LOW COST/NO COST

BLDG. #	ECO #	--THERMAL ENERGY--		-----ELECTRICAL ENERGY-----			TOTAL SAVINGS
		MBTU	DOLLARS	KWH	MBTU	DOLLARS	
1010	1	139	\$821	0	0	\$0	\$821
3080	1	102	\$601	0	0	\$0	\$601
4006	1	81	\$480	0	0	\$0	\$480
4126	1	121	\$713	0	0	\$0	\$713
5450	1	316	\$1,868	0	0	\$0	\$1,868
5460	1	440	\$2,600	0	0	\$0	\$2,600
6008	1	210	\$1,243	0	0	\$0	\$1,243
6016	1	114	\$672	0	0	\$0	\$672
6048	1	140	\$827	0	0	\$0	\$827
TOTALS		1663	\$9,825	0	0	\$0	\$9,825

TOTAL MBTU = 1663 THERMAL + 0 ELECT. = 1663 TOTAL MBTU

PROJECT #5

ENGINEERING CONSULTING RESOURCES, INC.
4609 South 2300 East, Salt Lake City, Utah, 84117

Consulting Engineers
(801) 277-7879

=====COST ESTIMATE SUMMARY=====

PROJECT: PROJECT #5 FUNDING = LOW COST/NO COST

REF: PROJ #5
DATE: AUG 1987
BY: CMY

DESCRIPTION:
PROJECT #5 :INTERIOR STORM WINDOWS
LOW COST/NO COST

BLDG. #	ECO #	CONSTRUCTION COST	CONTRACT COST	TOTAL COST
4126	2	\$7,312	\$877	\$8,190
4204	2	\$4,900	\$588	\$5,488
5222	2	\$14,331	\$1,720	\$16,051
5234	2	\$11,674	\$1,401	\$13,075
5460	2	\$27,262	\$3,271	\$30,534
5470	2	\$33,046	\$3,966	\$37,012
5474	2	\$1,743	\$209	\$1,952
6008	2	\$3,144	\$377	\$3,521
6048	2	\$790	\$95	\$885
TOTALS		\$104,203	\$12,505	\$116,708

ENGINEERING CONSULTING RESOURCES, INC.
4609 South 2300 East, Salt Lake City, Utah, 84117

Consulting Engineers
(801) 277-7879

=====SAVINGS SUMMARY=====

PROJECT: PROJECT #5 FUNDING = LOW COST/NO COST

REF: PROJ #5
DATE: AUG 1987
BY: CMY

DESCRIPTION:

PROJECT #5 :INTERIOR STORM WINDOWS
LOW COST/NO COST

BLDG. #	ECO #	--THERMAL ENERGY--		----ELECTRICAL ENERGY----		TOTAL	
		MBTU	DOLLARS	KWH	MBTU	DOLLARS	SAVINGS
4126	2	134	\$794	0	0	\$0	\$794
4204	2	59	\$350	0	0	\$0	\$350
5222	2	367	\$2,172	0	0	\$0	\$2,172
5234	2	246	\$1,457	0	0	\$0	\$1,457
5460	2	463	\$2,735	0	0	\$0	\$2,735
5470	2	473	\$2,799	0	0	\$0	\$2,799
5474	2	33	\$198	0	0	\$0	\$198
6008	2	71	\$419	0	0	\$0	\$419
6048	2	12	\$70	0	0	\$0	\$70
TOTALS		1858	\$10,994	0	0	\$0	\$10,994
TOTAL MBTU =		1858 THERMAL +		0 ELECT. =		1858 TOTAL MBTU	

PROJECT #6

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=====COST ESTIMATE SUMMARY=====

PROJECT: PROJECT #6 FUNDING = LOW COST/NO COST

REF: PROJ #6
DATE: AUG 1987
BY: CMY

DESCRIPTION:

PROJECT #6 :INFRARED OIL FIRED HEATERS
LOW COST/NO COST

BLDG. #	ECO #	CONSTRUCTION COST	CONTRACT COST	TOTAL COST
5470	18	\$137,885	\$16,546	\$154,431
TOTALS		\$137,885	\$16,546	\$154,431

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=====SAVINGS SUMMARY=====

PROJECT: PROJECT #6 FUNDING = LOW COST/NO COST

REF: PROJ #6
DATE: AUG 1987
BY: CMY

DESCRIPTION:

PROJECT #6 :INFRARED OIL FIRED HEATERS
LOW COST/NO COST

BLDG. #	ECO #	--THERMAL ENERGY--		----ELECTRICAL ENERGY----		TOTAL	
		MBTU	DOLLARS	KWH	MBTU	DOLLARS	SAVINGS
5470	18	1983	\$11,725	13966	48	\$1,234	\$12,959

TOTALS		1983	\$11,725	13966	48	\$1,234	\$12,959
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TOTAL MBTU = 1983 THERMAL + 48 ELECT. = 2031 TOTAL MBTU

PROJECT #7

ENGINEERING CONSULTING RESOURCES, INC.
4609 South 2300 East, Salt Lake City, Utah, 84117

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(801) 277-7879

=====COST ESTIMATE SUMMARY=====

PROJECT: PROJECT #7 FUNDING = LOW COST/NO COST

REF: PROJ #7
DATE: AUG 1987
BY: CMY

DESCRIPTION:

PROJECT #7 :LIGHTING, MOTOR & COOLER CONTROLS, CAULKING AND
LOW/NO WEATHER STRIPPING, POOL COVER & INFRARED HEATING

BLDG. #	ECO #	CONSTRUCTION COST	CONTRACT COST	TOTAL COST
1010	48	\$12,009	\$1,441	\$13,450
1012	50	\$337	\$40	\$377
1020	50	\$172	\$21	\$192
2032	60	\$103	\$12	\$115
3096	26	\$4,224	\$507	\$4,730
4010	3	\$1,762	\$211	\$1,973
4010	18	\$42,372	\$5,085	\$47,457
4110	43	\$57,445	\$6,893	\$64,338
4120	43	\$76,814	\$9,218	\$86,032
4132	60	\$206	\$25	\$230
4233	3	\$931	\$112	\$1,043
5111	26	\$6,973	\$837	\$7,810
5111	46	\$13,870	\$1,664	\$15,534
5222	26	\$7,684	\$922	\$8,606
5236	13	\$3,960	\$475	\$4,435
5236	48	\$13,637	\$1,636	\$15,273
5236	55	\$9,787	\$1,174	\$10,961
5314	26	\$13,659	\$1,639	\$15,298
5326	55	\$5,788	\$695	\$6,483
SUBTOTAL THIS PAGE		\$271,732	\$32,606	\$304,338

=====COST ESTIMATE SUMMARY=====

PROJECT: PROJECT #7

PAGE 2

REF: PROJ #7
DATE: AUG 1987
BY: CMY

DESCRIPTION:

PROJECT #7 :LIGHTING, MOTOR & COOLER CONTROLS, CAULKING AND
LOW/NO WEATHER STRIPPING, POOL COVER & INFRARED HEATING

BLDG. #	ECO #	CONSTRUCTION COST	CONTRACT COST	TOTAL COST
<hr/>				
SUBTOTAL PREV PAGE		\$271,732	\$32,606	\$304,338
5438	55	\$1,905	\$229	\$2,134
5450	3	\$4,141	\$497	\$4,638
5474	13	\$3,019	\$362	\$3,381
<hr/>				
TOTAL PAGES 1 & 2		\$280,797	\$33,693	\$314,490

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=====SAVINGS SUMMARY=====

PROJECT: PROJECT #7 FUNDING = LOW COST/NO COST

REF: PROJ #7
DATE: AUG 1987
BY: CMY

DESCRIPTION:

PROJECT #7 :LIGHTING, MOTOR & COOLER CONTROLS, CAULKING AND
LOW/NO WEATHER STRIPPING, POOL COVER & INFRARED HEATING

BLDG. #	ECO #	--THERMAL ENERGY--		----ELECTRICAL ENERGY----		TOTAL	
		MBTU	DOLLARS	KWH	MBTU	DOLLARS	SAVINGS
1010	48	129	\$765	25608	87	\$847	\$1,612
1012	50	0	\$0	1655	6	\$55	\$55
1020	50	0	\$0	827	3	\$27	\$27
2032	60	0	\$0	449	2	\$15	\$15
3096	26	194	\$1,149	0	0	\$0	\$1,149
4010	3	35	\$209	0	0	\$0	\$209
4010	18	1180	\$6,979	3871	13	\$128	\$7,107
4110	43	1644	\$9,719	-50598	-173	(\$1,675)	\$8,044
4120	43	3760	\$22,229	-106735	-364	(\$3,532)	\$18,697
4132	60	0	\$0	936	3	\$31	\$31
4233	3	19	\$113	0	0	\$0	\$113
5111	26	347	\$2,052	0	0	\$0	\$2,052
5111	46	246	\$1,453	0	0	\$0	\$1,453
5222	26	278	\$1,641	0	0	\$0	\$1,641
5236	13	0	\$0	20849	71	\$883	\$883
5236	48	197	\$1,164	12768	44	\$423	\$1,587
5236	55	0	\$0	32771	112	\$1,567	\$1,567
5314	26	347	\$2,052	0	0	\$0	\$2,052
5326	55	0	\$0	12257	42	\$792	\$792

SUBTOTAL THIS PAGE 8377 \$49,525 -45342 -155 (\$439) \$49,086

=====SAVINGS SUMMARY=====

PROJECT: PROJECT #7

PAGE 2

REF: PROJ #7
DATE: AUG 1987
BY: CMY

DESCRIPTION:

PROJECT #7 :LIGHTING, MOTOR & COOLER CONTROLS, CAULKING AND
LOW/NO WEATHER STRIPPING, POOL COVER & INFRARED HEATING

BLDG. #	ECO #	--THERMAL ENERGY--		----ELECTRICAL ENERGY----		TOTAL	
		MBTU	DOLLARS	KWH	MBTU	DOLLARS	SAVINGS
SUBTOTAL PREV PAGE		8377	\$49,525	-45342	-155	(\$439)	\$49,086
5438	55	0	\$0	6384	22	\$308	\$308
5450	3	121	\$715	0	0	\$0	\$715
5474	13	0	\$0	5924	20	\$389	\$389
TOTAL PAGES 1 & 2		8498	\$50,240	-33034	-113	\$258	\$50,498
TOTAL MBTU =		8498	THERMAL +	-113	ELECT. =	8385	TOTAL MBTU